Derivative

en.wikipedia.org/wiki/Derivative

Question:

What is derivative?

Properties of derivative:

Question:

m2 = 1: Give the properties of derivative: times constant, sum, difference, product, quotient.

Question:

m2 = 0: Prove expression for derivative of x2 using limit.

Question:

Find derivatives of these functions:

m4 = 0: ex

m4 = 1: xp

m4 = 2: cos(x)

m4 = 3:

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Chain rule

Question:

Calculate derivative, using Chain Rule for sin(Tx)

df =f’dx

dg = g’dx

Question:

Differential

m4 = 0: d(f+g) = df+dg

m4 = 1: d(f-g) = df-dg

m4 = 2: d(fg) = gdf+fdg

m4 = 3: d(f/g) = (gdf-fdg)/g^2

Application of derivative

A function f(x) is increasing if f’(x) > 0

A function f(x) is decreasing if f’(x) < 0

Question:

Increasing or decreasing:

m5 = 0. -6x

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m5 = 1. 9x

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m5 = 2. sin(x)

m5 = 3. cos(x)

m5 = 4. tan(x)

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Question:

Find min and MAX.

MAX and min are at points where f’(x) = 0, these are called critical points.

If f’(x) < 0 then f’(x) > 0, then there is minimum.

If f’(x) > 0 then f’(x) < 0, then there is MAXIMUM.

Find the largest area rectangle with perimeter of T meters.

P is Perimeter.

A is Area.

x is width.

y is height.

P = 2x+2y (1)

A = xy (2)

A is minimum when x = 0 or y = 0, in these cases A = xy = 0.

From (1)

(3)

We put y from equation (3) to equation (2)

(5)

Differentiating or taking the derivative from (5), we get (6)

(6)

x=0.25P

Derivative is positive at (-∞, )

If x < 0.25P, then then the derivative is positive:

Derivative is negative at ()

Therefore x = 0.25P is MAXIMUM.

x=0.25P (4)

Putting (4) into (3)

P = T.

T = s mod 100.

From (2)

Rectangle with the largest area is square, if perimeter is the same.

Calculate the largest area right-angled triangle with perimeter of T meters.

a = b

Find maximum volume cylinder for surface area of T meters square. T = 2πRH (5)

For maximum volume R = H.

Maximum volume is

Calculate maximum volume cone for surface area of T meters square. T = πRL

R = H

Calculate maximum area scalene triangle with perimeter of T meters.

All the sides of the triangle must be the same in length to achieve the largest area for the same perimeter.

Question:

Concave or convex:

m4 = 0: x3

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m4 = 1: -x3

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m4 = 2: cos(x)

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m4 = 3: sin(x)

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tan(x)

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/taninflectionpoints.docx

Question:

Find inflection point:

m4 = 0: x3

https://www.symbolab.com/solver/function-inflection-points-calculator

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m4 = 1: -x3

https://www.symbolab.com/solver/function-inflection-points-calculator

https://calculus12s.weebly.com/uploads/2/5/3/9/25393482/negativesecondderivative.docx

m4 = 2: cos(x)

https://www.symbolab.com/solver/function-inflection-points-calculator

m4 = 3: sin(x)

https://www.symbolab.com/solver/function-inflection-points-calculator

Linear regression:

Question:

Find linear least-square approximation for your dataset.

(2, m2), (3, m3), (4, m4)

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Dim x(3), y(3)

s = 23123456

m = 3

x(1) = 2

x(2) = 3

x(3) = 4

y(1) = s mod 2

y(2) = s mod 3

y(3) = s mod 4

sx = 0

For j = 1 To m

sx = sx + x(j)

Next j

sy = 0

For j = 1 To m

sy = sy + y(j)

Next j

sxy = 0

For j = 1 To m

sxy = sxy + x(j) \* y(j)

Next j

sx2 = 0

For j = 1 To m

sx2 = sx2 + x(j) ^ 2

Next j

g = (m \* sxy - sx \* sy) / (m \* sx2 - sx ^ 2)

i = (sy - g \* sx) / m

MsgBox g

MsgBox i

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Partial derivative is derivative with respect to one variable, considering all the other variables as constants.

Question:

Find partial derivatives.

m2 = 0: x + y

m2 = 1: xy

Total derivative is when we calculate the sum of all the partial derivatives.

y(x)

Question:

Calculate total derivative.

m2 = 0: x + y

m2 = 1: xy

Implicit function

Implicit function cannot be easily resolved with respect to y = f(x).

F(x,y)=0

F(x,y) =Lx2 + Ty2 – k = 0

F(x,y) =4x2 + 14y2 – 7000 = 0

To calculate derivative of implicit function, we take total derivative of the implicit function and express y’ from this equation.

Question:

Find implicit function derivative. Lx2 + Ty2 – k = 0

Inverse function

Inverse function undoes what the function does.

Derivative of inverse function is one over derivative of the function.

For inverse function we swap x and y.

becomes

inverse function of 14x + 4 is

x = 14y + 4,

Derivative of inverse function is 1/T.

Question:

Calculate inverse function derivative y = Tx + L.

Derivative is linear.

Derivative is local operation.

Question:

Calculate derivatives of these functions:

x

1/x

Sin(x)

Cos(x)

Tan(x)

Cot(x)

Log(x)

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